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Effects of chiropractic care on dizziness, neck pain, and balance: a single-group, preexperimental, feasibility study☆

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Abstract

Objective: This feasibility study was conducted to further the development of a line of investigation into the potential effects of spinal manipulation/manual therapy on cervicogenic dizziness, balance, and neck pain in adults.

Methods: A single-group, preexperimental, feasibility study was conducted at a chiropractic college health center and a senior fitness center with a target sample size of 20 patients (40 years or older). Patients were treated by either a clinician or a chiropractic student intern for 8 weeks. The Dizziness Handicap Inventory was the primary outcome measurement, with the Short Form Berg Balance Scale (SF-BBS) and the Neck Disability Index used as secondary outcome measurements.

Results: Twenty-seven patients were recruited over a period of 13 months. Twenty-one patients enrolled in the study; but because of 2 dropouts, 19 patients completed the treatment. A median Dizziness Handicap Inventory change score of +7 points was calculated for those dizziness patients, with 3 patients improving by at least 18 points, indicating a clinically meaningful change. Seven of the 15 patients who performed the SF-BBS attained at least a 4-point improvement with an effect size of 1.2. A median Neck Disability Index change score of +1 was calculated for those patients with neck pain. Twelve minor adverse reactions were reported by 8 patients, with 3 of those reactions lasting longer than 24 hours.

Conclusion: A large effect size was calculated for the SF-BBS. Most patients demonstrated improved balance, and some showed reduced dizziness and neck pain. Involving interns in

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care proved feasible. Further studies with comparison groups and larger samples are needed to explore the promising results of this study before any cause and effect relationship can be determined.

Introduction

Dizziness is a common problem that can often lead to disability or psychologic distress in middle-aged and older adults.[1-3] A subcategory of dizziness is cervicogenic dizziness, characterized by symptoms of sensations of excessive motion, imbalance, or spinning associated with neck pain and stiffness.[4] Cervicogenic dizziness is thought to be caused by abnormal sensory afferent stimulation in the cervical spine.[5] Presently, there is some evidence to advocate the use of spinal manipulation (SM) or other manual therapy (MT) techniques for this condition. Most of the existing studies looking at the effect of SM/MT on cervicogenic dizziness are either case reports, single-subject designs, or observational studies.[6] Only 2 randomized controlled trials (RCTs) have been published to date; only the study by Reid et al was adequately powered to detect between-group differences.[7,8] Both RCTs suggested a benefit of MT/SM for dizziness of cervical spine origin. Furthermore, 2 systematic reviews that included not only RCTs but other study designs as well suggest that SM/MT to the cervical spine may be beneficial for individuals with cervicogenic dizziness, especially when these individuals have neck pain and/or cervical spine dysfunction.[6,9]

Like dizziness, poor balance in older adults is a significant problem as evident by the fact that one third of community-dwellers over the age of 65 years experience a fall and half of those have a repeat fall.[10] Falls are a leading cause of nonfatal injury in older adults and account for two thirds of all unintentional injury deaths in this population.[11] The cause of falls is considered multifactorial, with impairments in balance, gait, and activities of daily living, as well as lower extremity weakness and/or dysfunction being the most significant modifiable risk factors.[12] Preliminary research shows a link between neck pain/dysfunction/dizziness and poor postural control. It has been shown that patients with neck pain have altered abilities to perceive vertical orientation and have poorer postural control when compared with patients without neck pain.[13,14] In a small RCT, it was demonstrated that patients with neck pain and dizziness exhibited poorer postural performance than did asymptomatic patients. After a course of MT, the cervicogenic dizziness patients had significantly reduced neck pain and dizziness and improved postural performance.[7] At this time, there have been only 4 small experimental studies that have investigated the effects of chiropractic care on balance.[15-18] The purpose of this study was to collect preliminary information on the effects of chiropractic care (SM/MT) on cervicogenic dizziness, balance, and neck pain.

Methods

This project was a single-group, preexperimental, feasibility study conducted to further the development of a line of investigation into the potential effects of SM/MT on cervicogenic dizziness, balance, and neck pain in adults. Its specific aims were to (1) assess the feasibility of implementing various study treatment and examination protocols in a traditional teaching-based clinic; (2) describe baseline characteristics of enrolled patients; (3) describe and assess patient outcomes in terms of dizziness, balance, neck pain, and the occurrence of minor adverse reactions to chiropractic care.

Safety and human subjects considerations

The study was approved by the institutional review board of the Cleveland Chiropractic College before recruitment, and all patients signed an informed consent form before any data collection or treatment.

Study population

For this feasibility study, we targeted a sample size of 20 patients. Eligibility criteria were as follows:

Inclusion: (1) aged 40 years or older and (2) recurrent episodes of dizziness (by self report) and/or mechanical neck pain for least 4 weeks' duration.

Exclusion: (1) previous history of stroke, or a diagnosis of a bleeding disorder, or currently

undergoing anticoagulation treatment; (2) chiropractic care within the past 2 weeks (by self report); (3) currently receiving treatment for dizziness/neck pain by other health care providers; (4) presence of inflammatory joint disease, infection, tumor, or fracture of the spine or cranium, central vascular/neurologic condition suspected of causing neck pain and/or dizziness/vertigo or other conditions contraindicating high-velocity, small-amplitude spinal manipulative therapy; (5) inability to read and speak English; (6) evidence of narcotic or other drug abuse; (7) an ongoing personal injury or workers' compensation case related to dizziness/vertigo or neck pain; or (8) currently seeking or receiving disability for dizziness/vertigo or neck pain.

Recruitment strategies

Potential patients were recruited through (1) ads in a local health-oriented magazine; (2) on-campus study flyers; (3) word of mouth and referrals through college employees, students, and clinic patients; and (4) screenings at an area fitness center catering to older adults.

Study protocol

We screened volunteers for preliminary eligibility by phone or at off-site events. If eligible, they were mailed a packet of baseline questionnaires and study-related information and were scheduled for a baseline visit. On the baseline visit, a study coordinator confirmed their preliminary eligibility, explained the study, obtained informed consent, and administered the Short Form Berg Balance Scale (SF-BBS). An a priori decision was made to test balance only on patients who were older than 50 years because of the greater likelihood of poor balance in older age groups. To complete this visit, a clinician performed a detailed physical examination and radiographs (if needed) to determine final eligibility.

Interventions

We developed the intervention to reflect common chiropractic practice. As a result, the intervention incorporated various SM/MT techniques such as diversified, instrument assisted, drop table spinal manipulative therapy, flexion distraction, soft tissue therapy such as myofascial release, postisometric relaxation, and heat or cold. The interventions were tailored to each patient and were performed by clinicians and chiropractic interns at the college's health clinics and at a satellite clinic. All patients were scheduled for 2 visits per week during the 8-week intervention period. Each visit took approximately 15 to 20 minutes.

Training

The interns who were eligible to participate had to have completed all student clinic requirements, thus giving them clearance to see patients in the college's outpatient clinics. They must have had also completed the college's geriatrics course. The interns were chosen to participate through a qualitative process that consisted of faculty recommendations and the principal investigator's assessment of their competency in multiple treatment techniques such as diversified, Graston, and/or Activator.

Training clinic and research personnel in the study's protocols is essential before the start of the study to maximize patient safety and to minimize missing outcome data. These 2 goals are important to specific aim no. 1. Intern training was supervised by the principal investigator. The intern was instructed on how to best treat and manage the patient that included the type of technique(s) to perform, the location of the structures (spinal levels, muscles, etc) to be treated, and the study protocols (reporting of adverse reactions, patient schedule, testing/outcome questionnaire administration) before the start of the patient's care. The interns treated under the supervision of the clinicians in the college's outpatient clinics. Clinic staff, clinicians, and research coordinators were oriented to the study's protocols before the start of the study. This was done primarily through e-mails and meetings. The 2 primary treating clinicians had at least 5 years of experience.

Assessment methods and instruments

Baseline data collected on all patients included demographics, health history, medication use, and health habits including fluid intake. Outcome measures were administered at baseline and after 8 weeks of treatment.

The Dizziness Handicap Inventory (DHI) was the primary outcome measure. It is a 25-item self-administered questionnaire that has been shown to be valid, reliable, and sensitive to change, with a maximum score of 100 points indicating severe disability and with 18 points indicating a clinically important change.[19,20]

The SF-BBS is a 7-item functional test that measures a patient's balance. It has a total score of 28, with

Table 1 Demographics and baseline characteristics (n = 19)

Demographics	n (%)
Sex, female	12 (63%)
Median age in years (minimum, maximum)	70 (44, 85)
Race/ethnicity	
White	18 (95%)
Black/African American	1 (5%)
Marital status	
Married/living with partner	14 (74%)
Living alone	2 (10%)
Living alone because of death of spouse	3 (16%)
Educational level	
Some high school	0
High school graduate	4 (21%)
Some college	5 (26%)
College degree	5 (26%)
Trade or technical school	3 (16%)
Postgraduate degree	2 (11%)
Employment status	
Employed full-time	6 (32%)
Employed part-time	2 (10%)
Retired	11 (58%)
Health habits	
Alcohol use	
Never	10 (53%)
Former use	1 (5%)
Occasionally	8 (42%)
Tobacco use	
Current use	1 (5%)
Former use	4 (21%)
Never used	14 (74%)
Water/other liquid (median cups per day)	8 (2, 16)
Aerobic exercise like walking	
Never	4 (21%)
1-2 times/wk	7 (37%)
3 or more times/wk	8 (42%)
Other exercise (like stretching, gardening)	
Never	2 (10%)
1-2 times/wk	7 (37%)
3 or more times/wk	10 (53%)
Health status	
Median no. of medications (minimum, maximum)	4 (0, 10)
Median body mass index (minimum, maximum)	27 (21, 43)
Artificial joints (knee, hip, or ankle)	2 (10%)
Median baseline FABQ score (minimum, maximum) [a]	28 (0, 57)
Median baseline FABQ-PA subscale score (minimum, maximum) [b]	11 (0, 24)
Median baseline NDI score [c] (minimum, maximum)	22 (2, 52)
Median baseline DHI score [d] (minimum, maximum)	33 (12, 52)
Median baseline SF-BBS score [e] (minimum, maximum)	20 (16, 24)

[a] Higher FABQ scores indicate greater degree of fear and avoidance beliefs; maximum score is 96.
[b] Higher FABQ-PA scale scores indicate greater degree of fear and avoidance beliefs; maximum score is 24.
[c] Higher NDI scores indicate higher levels of pain-related disability; maximum score is 100%.
[d] Higher DHI scores indicate higher levels of dizziness-related disability; maximum score is 100.
[e] Lower SF-BBS scores indicate poorer balance; maximum score is 28.

higher scores indicating better balance. It has demonstrated good reliability and responsiveness.[21] The SF-BBS was only performed on patients 50 years or older. Effect sizes (standardized mean differences) for the SF-BBS were calculated by dividing the mean change score by the baseline standard deviation.[21]

The Neck Disability Index (NDI) is a 10-item questionnaire that has been found to have good reliability as well as good construct and concurrent validity in an ambulatory clinic population.[22] The total NDI scores were converted to a percentage score (0-100). A 21-point change (scale range, 0%-100%) is considered a clinically important change.[23]

The Fear-Avoidance Beliefs Questionnaire (FABQ) is a 16-item questionnaire that measures beliefs about physical activity and work. The total FABQ has excellent test-retest reliability (intraclass correlation coefficient = 0.97) over a 30-minute period, with a maximum score of 96.[24] Test-retest reliability of the FABQ physical activity subscale (FABQ-PA) is acceptable (intraclass correlation coefficient = 0.72-0.90), with a maximum score of 24.[25,26] For both the total score and PA subscale, higher scores indicate a greater degree of fear and avoidance beliefs. The work subscale was not calculated because of the large proportion of patients who were retired. A clinical meaningful change value has not been established. In this study, the questionnaire was modified for neck pain patients.

A change score was calculated for each of the 4 outcome instruments by subtracting the 8-week score

from the baseline score. Data analysis was performed using SPSS PC for Windows, version 17.0 (SPSS, Chicago, IL). Descriptive statistics were performed on baseline and outcome variables. Preliminary exploratory comparisons were made between patients with neck pain, dizziness, and balance changes.

Results

Twenty-seven volunteers were screened, of which 6 did not meet the inclusion criteria, leaving a total of 21 participants enrolled into the study. Fourteen patients were recruited from the area fitness center, 5 from flyers in the college's health clinic, 5 from college employee and student referrals, 1 from an area field chiropractor, 1 from a church health screening, and 1 that was ineligible from a concurrent study. Of these, 6 were ineligible because of the absence of neck pain or dizziness/vertigo (n = 2), a diagnosis of benign paroxysmal positional vertigo (n = 1), anticoagulation treatment (n = 1), narcotic abuse (n = 1) and central vascular/neurological cause of dizziness (n = 1). Twenty-one patients were enrolled into the study over a period of 13 months; and of these, 2 patients dropped out of the study. One dropped out because of the difficulty of getting an appointment with the intern, and the other dropped out for unknown reasons. The patients who dropped out were similar to study completers in demographic characteristics and baseline outcome scores except for 1 patient who had a lower DHI score. Patients who completed the study had a median age of 70 years, were mostly female (63%), were retired (58%), and were white (95%) (Table 1). They reported relatively healthy lifestyle habits; 43% exercised 3 or more times per week, 74% never used tobacco, and 53% never used alcohol. Out of the 19 patients who completed the study, 12 were treated by a clinician and 7 were treated by an intern. Both the intern- and clinician-treated patients were seen a median number of 15 visits, and all patients had the same caregiver throughout the study.

The median number of medications reported being taken at baseline was 4, with 0 being the least number and 10 being the highest. Cholesterol and hypertension medications (n = 6 each) were the most common

Table 2 Outcomes scores by patient ordered by DHI baseline score (n = 21)

Patient ID	DHI [a]			NDI (%) [b]			FABQ-PA [c]		
	Baseline [d]	Wk 8 [d]	Change	Baseline [d]	Wk 8 [d]	Change	Baseline	Wk 8	Change
654	52	48	4	40	42	−2	15	15	0
097	46	52	−6	44	44	0	11	6	5
405	42	38	4	–	–	–	14	8	6
593	42	30	12	24	24	0	0	9	−9
577	40	10	30	24	20	4	24	20	4
766	34	12	22	–	18	−18	18	17	1
916	32	30	2	30	20	10	[f]	22	–
700	30	14	16	52	34	18	20	8	12
015	24	0	24	–	–	–	4	4	0
622 [e]	24	–	–	34	–	–	–	–	–
071	22	14	8	8	4	4	0	11	−11
765	22	16	6	14	36	−22	18	11	7
588	12	18	−6	12	12	0	0	10	−10
250 [e]	–	–	–	12	–	–	8	–	–
811	–	–	–	20	8	12	20	14	6
830	–	–	–	10	14	−4	6	10	−4
485	–	–	–	26	14	12	16	10	6
616	–	–	–	14	14	0	14	8	6
746	–	–	–	44	2	42	10	4	6
883	–	–	–	2	0	2	0	3	−3
905	–	–	–	10	10	0	6	2	4

[a] Higher DHI scores indicate higher levels of dizziness-related disability; maximum score is 100; negative value ("−") indicates worsening effect.

[b] Higher NDI scores indicate higher levels of pain-related disability; maximum score is 100%.

[c] Higher FABQ-PA scale scores indicate greater degree of fear and avoidance beliefs; maximum score is 24.

[d] Empty cells ("–") indicate no self report of dizziness or neck pain.

[e] Patient dropped out.

[f] Indicates missing values.

Table 3 Outcome scores of SF-BBS (n = 15)

Dizziness [a]	Patient ID	Baseline	Wk 8	Change [b]
No	811	18	22	+4
	883	18	20	+2
	830	20	22	+2
	905	20	24	+4
	485	22	28	+6
	616	22	24	+2
	746	24	26	+2
Yes	405	16	22	+6
	588	16	20	+4
	593	18	[c]	[c]
	071	18	24	+6
	654	20	18	−2
	577	22	[a]	[a]
	765	22	28	+6
	766	22	24	+2

Plus sign indicates improvement; minus sign indicates worsening effect. SF-BB scale is 0 to 28.

[a] By self report.

[b] Change score = SF-BBS baseline score–SF-BBS 8 week score.

[c] Indicates missing value.

among patients, followed by heart disease and heart burn/reflux (n = 5 each) and allergy and osteoporosis (n = 4 each). Medications were also being taken for depression (n = 2), asthma (n = 2), diabetes (n = 2), gout (n = 2), pain (n = 2), prostate problems (n = 2), dermatitis/rosacea (n = 2), thyroid (n = 2), and hair loss (n = 2).

Thirteen of the 19 patients presented with a self report of dizziness; and of these, one dropped out. The 12 dizziness patients had a median change score of 7 (−6, 30) points on the DHI from baseline to 8 weeks (Table 2). Three patients improved by at least 18 points on the DHI, indicating a clinically meaningful change. Four other patients improved by 8 to 16 points.

Seven of the 15 patients who performed the SF-BBS attained at least a 4-point improvement from baseline to week 8 (Table 3). With a mean change score of 3.0 and a baseline standard deviation of 2.6, an effect size of 1.2 was calculated. Most patients had at least some improvement in balance regardless of whether dizziness was present or of the status of neck pain.

Eighteen of the 19 patients presented with a self report of neck pain; and of these, 2 dropped out. The 16 neck pain patients had a median change score of 1 point (−22,42) on the NDI from baseline to 8 weeks (Table 2). One patient improved by at least 21 points on the NDI, indicating a clinically meaningful change. Four other patients improved by 10 to 18 points. Because neck pain is thought to accompany cervicogenic dizziness, we compared the 2 conditions. Ten of the 13 patients who had dizziness also had neck pain. Patients with dizziness had a higher median baseline NDI score (24%) than

Table 4 Adverse reactions by patient

Patient ID	Age	Dizziness [a]	Adverse Reaction Types	Duration in Hours	Patient Comorbidities [b]	Technique Performed [b]
593	75	Yes	Headache	6		
			Headache	2		
405	73	Yes	Dizziness	4		
654	77	Yes	Unsp tenderness	1		
			CT soreness	2		
916	70	Yes	Dizziness, neck pain	3-4		
588	86	Yes	Headache/neck pain	Few seconds to minutes		
097	48	Yes	Mid back pain	>24	Fibromyalgia, Celiac disease	Diversified
622	84	Yes	Unsp soreness	Few minutes	Cardiovascular disease	
			Low back pain	24-48		Flexion distr/drop
485	54	No	Headache and stiff neck	48	Fibromyalgia	Instrument assisted
			Mid back pain	<24		

Unsp, Unspecified; CT, cervicothoracic spine; *flexion distr*, flexion distraction to lumbar spine; *drop*, drop technique to pelvis.

[a] A presenting complaint of dizziness by self report.

[b] Reported for adverse reactions longer than 24 hours only.

those with no dizziness (NDI = 14%). The patients with neck pain, either with or without dizziness, showed no or very little improvement on the NDI.

All patients received soft tissue treatment as well as SM at each visit, with interns and clinicians delivering similar configurations of procedures. Twelve minor adverse reactions to treatment were reported by 8 patients, with 3 of those reactions lasting longer than 24 hours (Table 4). The most common reactions documented were headaches, dizziness, and neck and back soreness.

Discussion

The purpose of this study was a feasibility study to collect preliminary information on the effects of chiropractic care (SM/MT) on cervicogenic dizziness, balance, and neck pain; this "Discussion" section will focus on the specific aims of feasibility.

Our first specific aim was to assess the feasibility of implementing various study treatment and examination protocols in a teaching-based college health clinic. Implementing experimental clinical research studies in chiropractic college teaching clinics has been acknowledged as a challenging endeavor because of competition for space and patients, faculty time constraints, and lack of faculty training, among others.[27] Given the challenges of implementing clinical research in a teaching clinic, we believed the benefits of conducting research in our clinic outweighed the challenges. Improving the education for interns and encouraging an integration of an evidence-based practice approach into academia were important benefits of conducting research in our teaching clinics. Interns earned adjustment, physical examination, and radiograph credits when they performed these services on research patients.

Three instances of missing outcome data were reported throughout the study (baseline FABQ, n = 1; week-8 SF-BBS, n = 2). Where the goal of any study is to have no missing data, we believe the 3 instances in this study represented a minor concern. One of our areas we had to monitor most closely was the scheduled administration of outcome forms and balance testing in the patients who were treated by interns. In the future, studies that have intern participation may need improved patient visit monitoring protocols to ensure all forms and testing are administered in a timely fashion. In terms of maximizing patient safety, it is important to note that the frequency of minor adverse reactions was no greater among intern-treated patients than among clinician-treated patients. Furthermore, intern-treated patients improved as much on the DHI as the clinician-treated patients. Because of the low amount of missing data and a rate of minor adverse reactions comparable to other studies especially in intern-treated patients, it is our opinion this study was feasible to perform in our outpatient (teaching-based) clinic system.

Our second specific aim was to describe baseline characteristics of enrolled patients. This was successfully accomplished. Compared with reported characteristics in other dizziness studies, our patient sample was similar in sex and age, except that our sample was significantly older than the sample of patients seen in the study by Karlberg et al.[7]

Our final specific aim was to describe and assess patient outcomes in terms of dizziness, balance, neck pain, and the occurrence of minor adverse reactions to treatment. Some of the dizziness patients showed improvement after 8 weeks of treatment. Although neck pain accompanied 10 of the 13 patients who had dizziness, we did not observe any correlations between patients with and without neck pain and reduced DHI scores. Similar to the dizziness patients, some of the neck pain patients showed improvement after 8 weeks of treatment. Because of study limitations, we were unable to draw conclusions about the differential response to treatment among patients.

Improvement in scores on the SF-BBS showed a large effect size of 1.2. Based on this observation, we believe a 3-point change may be clinically meaningful on the SF-BBS. Because the amount of change that is clinically meaningful on this measure has not yet been established, this finding may be useful in future studies using it to assess outcomes. Although these results are promising, we emphasize that in this small sample with no comparison groups, the results could be attributed to other factors besides the study treatment.

Eight patients (38%) reported 12 minor, transient adverse reactions during the treatment period. The frequency recorded in our study was similar to several published observational and experimental clinical studies where the frequencies of minor, transient adverse reactions recorded ranged from 9% to 55%.[28-33]

Limitations

No comparison or control groups, and a small sample size were the main limitations of this study. Limitations such as these make it inappropriate to make inferences about treatment efficacy for the delivered treatment. It is

possible that other patient characteristics (eg, level of psychologic stress, the effects on patient's symptoms by comorbid conditions such as fibromyalgia and degenerative joint disease/osteoarthritis) or treatment parameters that we did not record might have influenced the outcomes. It is possible that differing levels of expertise of the doctors and interns delivering care may have influenced the outcomes, although our results tend not to support that possibility. Future studies may need to collect more in-depth information about such characteristics. Because recruitment was primarily centered on people associated with a chiropractic college and/or a fitness center, we acknowledge that another limitation of this study was that our patient sample may have been slanted toward a health-conscious patient. Because a criterion standard test is not available, making a diagnosis of cervicogenic dizziness is not always definitive. It is possible that specific medications could cause dizziness or imbalance, but the degree that medications play is not always clear because of the ambiguity that exists in a patient's history and physical examination. As a result of this ambiguity, the type of medication may be another confounding variable as to why some patients did not have complete resolution of their dizziness or imbalance. These limitations should be considered in future studies.

Conclusion

A large effect size was calculated for the SF-BBS. Most patients demonstrated improved balance, and some showed reduced dizziness and neck pain after 8 weeks of chiropractic care; but because of the small sample size, no subgroup analysis was performed. Involving interns and implementing examination/treatment study protocols in the health clinic proved feasible because the amount of missing data was low, adverse effects were no greater among intern-treated patients, and the DHI outcome scores were comparable to those among clinician-treated patients. Further studies with comparison groups and larger sample sizes are needed to further explore the promising results of this study before any cause and effect relationships can be determined.

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References

1. Yardley L, Owen N, Nazareth I, Luxon L. Prevalence and presentation of dizziness in a general practice community sample of working age people. Br J Gen Pract 1998;48(429):1131-5.
2. Colledge NR, Wilson JA, Macintyre CC, MacLennan WJ. The prevalence and characteristics of dizziness in an elderly community. Age Ageing 1994;23(2):117-20.
3. Sloane P, Blazer D, George LK. Dizziness in a community elderly population. J Am Geriatr Soc 1989;37(2):101-8.
4. Wrisley DM, Sparto PJ, Whitney SL, Furman JM. Cervicogenic dizziness: a review of diagnosis and treatment. J Orthop Sports Phys Ther 2000;30(12):755-66.
5. Brandt T, Bronstein AM. Cervical vertigo. J Neurol Neurosurg Psychiatry 2001;71(1):8-12.
6. Reid SA, Rivett DA. Manual therapy treatment of cervicogenic dizziness: a systematic review. Man Ther 2005;10(1):4-13.
7. Karlberg M, Magnusson M, Malmstrom EM, Melander A, Moritz U. Postural and symptomatic improvement after physiotherapy in patients with dizziness of suspected cervical origin. Arch Phys Med Rehabil 1996;77(9):874-82.
8. Reid SA, Rivett DA, Katekar MG, Callister R. Sustained natural apophyseal glides (SNAGs) are an effective treatment for cervicogenic dizziness. Man Ther 2008;13(4):357-66.
9. Hawk C, Khorsan R, Lisi AJ, Ferrance RJ, Evans MW. Chiropractic care for nonmusculoskeletal conditions: a systematic review with implications for whole systems research. J Altern Complement Med 2007;13(5):491-512.
10. Lajoie Y, Gallagher SP. Predicting falls within the elderly community: comparison of postural sway, reaction time, the Berg balance scale and the Activities-specific Balance Confidence (ABC) scale for comparing fallers and non-fallers. Arch Gerontol Geriatr 2004;38(1):11-26.
11. Tinetti ME. Clinical practice. Preventing falls in elderly persons. New England Journal of Medicine 2003;348(1):42-9.
12. Moreland J, Richardson J, Chan DH, et al. Evidence-based guidelines for the secondary prevention of falls in older adults. Gerontology 2003;49(2):93-116.
13. Grod J, Diakow P. Effect of neck pain on verticality perception: a cohort study. Archives of Physical Medicine and Rehabilitation 2002;83(3):412-5.
14. Vuillerme N, Pinsault N. Experimental neck muscle pain impairs standing balance in humans. Exp Brain Res 2009;192(4):723-9.
15. Hawk C, Rupert R, Colonvega M, Hall S, Boyd J, Hyland J. Chiropractic care for older adults at risk for falls: a preliminary assessment. J Am Chiropr Assoc 2005;42(September/October):10-8.

16. Hawk C, Pfefer M, Strunk R, Ramcharan M, Uhl N. Feasibility study of short-term effects of chiropractic manipulation on older adults with impaired balance. J Chiropr Med 2007;6:121-31.
17. Hawk C, Cambron J. Chiropractic care for older adults: effects on balance, dizziness and chronic pain. J Manipulative Physiol Ther 2009;32.
18. Hawk C, Cambron J, Pfefer MT. Pilot study of the effect of a limited and extended course of chiropractic care on balance, chronic pain and dizziness in older adults. J Manipulative Physiol Ther 2009;32.
19. Jacobson GP, Newman CW. The development of the Dizziness Handicap Inventory. Arch Otolaryngol Head Neck Surg 1990; 116(4):424-7.
20. Clendaniel R. Outcome measures for assessment of treatment of the dizzy and balance disorder patient. Otolaryngol Clin North Am 2000;33(3):519-33.
21. Chou C, Chien C, Hsueh I, Sheu C, Wang C, Hsieh C. Developing a short form of the Berg Balance Scale for people with stroke. Phys Ther 2006;86(2):195-204.
22. Vernon H, Mior S. The Neck Disability Index: a study of reliability and validity. J Manipulative Physiol Ther 1991;14(7): 409-15.
23. Pool JJ, Ostelo RW, Hoving JL, Bouter LM, de Vet HC. Minimal clinically important change of the Neck Disability Index and the Numerical Rating Scale for patients with neck pain. Spine 2007;32(26):3047-51.
24. Kovacs FM, Muriel A, Medina JM, Abraira V, Sanchez MD, Jauregui JO. Psychometric characteristics of the Spanish version of the FAB questionnaire. Spine 2006; 31(1):104-10.
25. Pfingsten M, Kroner-Herwig B, Leibing E, Kronshage U, Hildebrandt J. Validation of the German version of the Fear-Avoidance Beliefs Questionnaire (FABQ). Eur J Pain 2000; 4(3):259-66.
26. Chaory K, Rannou F, Fermanian J, et al. [Impact of functional restoration programs on fears, avoidance and beliefs in chronic low back pain patients]. Ann Readapt Med Phys 2004;47(3): 93-7.
27. Hawk C, Cambron J, Pahmeyer D. Issues in conducting research in chiropractic college clinics. J Manipulative Physiol Ther 2008;31(4):301-7.
28. Senstad O, Leboeuf-Yde C, Borchgrevink C. Frequency and characteristics of side effects of spinal manipulative therapy. Spine 1997;22(4):435-40.
29. Leboeuf-Yde C, Hennius B, Rudberg E, Leufvenmark P, Thunman M. Side effects of chiropractic treatment: a prospective study. J Manipulative Physiol Ther 1997;20(8):511-5.
30. Barrett AJ, Breen AC. Adverse effects of spinal manipulation. J R Soc Med 2000;93(5):258-9.
31. Bronfort G, Evans R, Nelson B, Aker PD, Goldsmith CH, Vernon H. A randomized clinical trial of exercise and spinal manipulation for patients with chronic neck pain. Spine 2001; 26(7):788-97 discussion 98-9.
32. Hoving JL, Koes BW, de Vet HC, et al. Manual therapy, physical therapy, or continued care by a general practitioner for patients with neck pain. A randomized, controlled trial. Ann Intern Med 2002;136(10):713-22.
33. Hurwitz EL, Morgenstern H, Vassilaki M, Chiang LM. Frequency and clinical predictors of adverse reactions to chiropractic care in the UCLA neck pain study. Spine 2005; 30(13):1477-84.